

(12) **UK Patent Application** (19) **GB** (11) **2 397 179** (13) **A**

(43) Date of A Publication **14.07.2004**

(21) Application No: **0212598.1**

(22) Date of Filing: **30.05.2002**

(71) Applicant(s):  
**Tamagawa Seiki Kabushiki Kaisha**  
(Incorporated in Japan)  
**1879 Ooyasumi, Iida-shi, Nagano-ken,**  
**Japan**

(72) Inventor(s):  
**Nishida Shigeru**  
**Atsushi Kindaichi**

(74) Agent and/or Address for Service:  
**Marks & Clerk**  
**57-60 Lincoln's Inn Fields, LONDON,**  
**WC2A 3LS, United Kingdom**

(51) INT CL<sup>7</sup>:  
**H02K 5/22 // H02K 3/28**

(52) UK CL (Edition W):  
**H2A ART5 AR121 AR216S AR705 AR706 AR714**

(56) Documents Cited:  
**US 4039875 A**  
**PAJ abstract & JP 2000125495 A (Matsushita)**  
**PAJ abstract & JP 61214740 A (Matsushita)**  
**PAJ abstract & JP 58009563 A (Mitsubishi)**  
**PAJ abstract & JP 9327165 A (Janome sewing**  
**machine)**  
**PAJ abstract & JP 10191615 A (Tokyo Electric)**  
**PAJ abstract & JP 62290343 A (Matsushita)**

(58) Field of Search:  
**UK CL (Edition T) H2A ARB4 ARD3 ART5**  
**INT CL<sup>7</sup> H02K 3/28 3/50 5/22**  
**Other: Online databases: EPODOC, JAPIO, WPI**

(54) Abstract Title: **Stator structure having a printed circuit board with terminals connected thereto**

(57) The windings of a machine stator 1 are connected to tracks 11 on a printed circuit board 10. A portion 10A of the circuit board 10 extends beyond the periphery of the stator. Tracks 11 extend onto portion 10A of the board and end at pads / holes 20 which are through-hole plated with a conductive film in a known manner. Either a connector 30 (fig. 1) or lead wires may be inserted into holes 20. As portion 10A of the board and holes 20 are located beyond the periphery of the stator, the connector or the lead wires may be attached after the stator has been sealed with resin.

**FIG. 2**

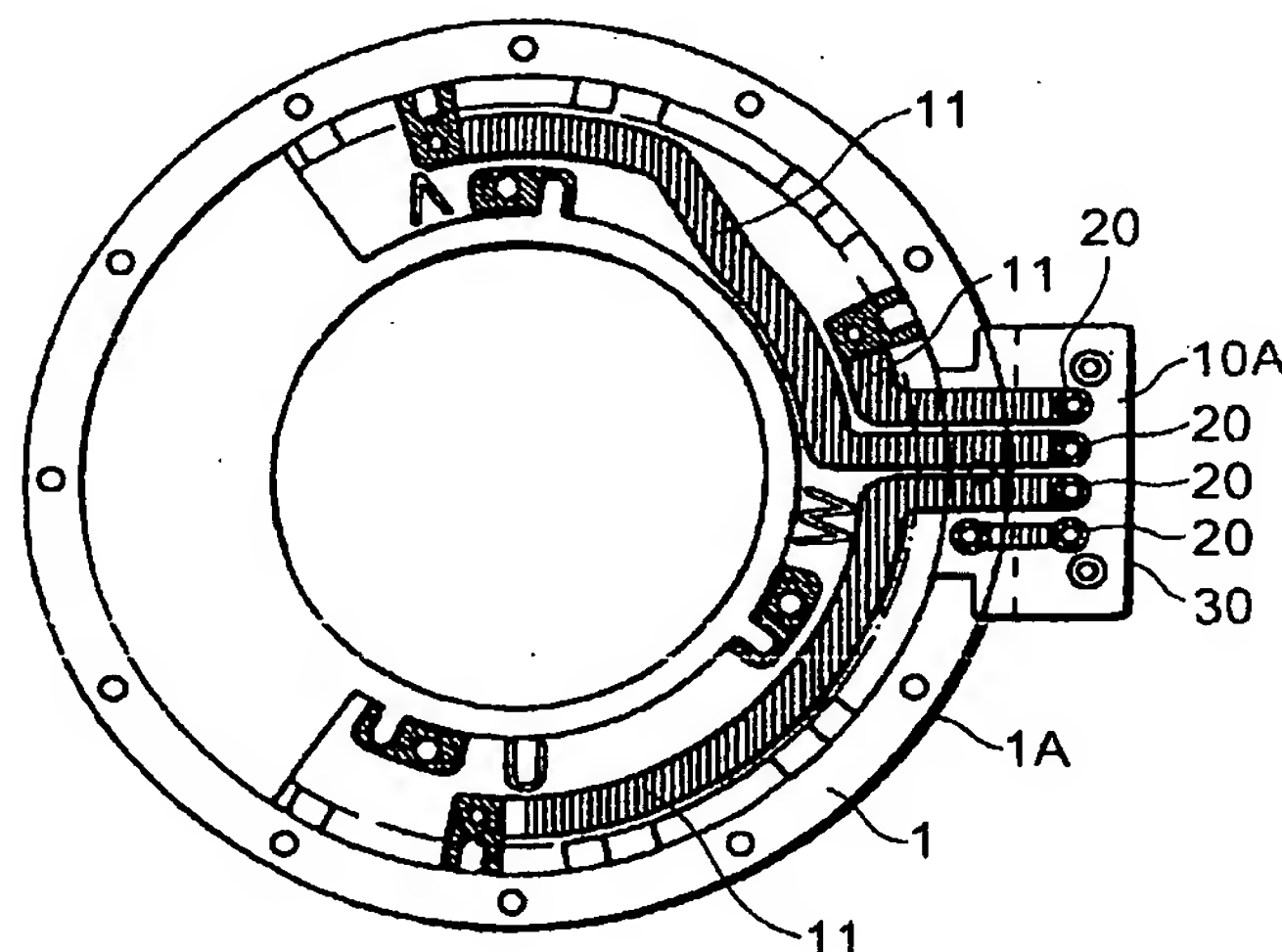
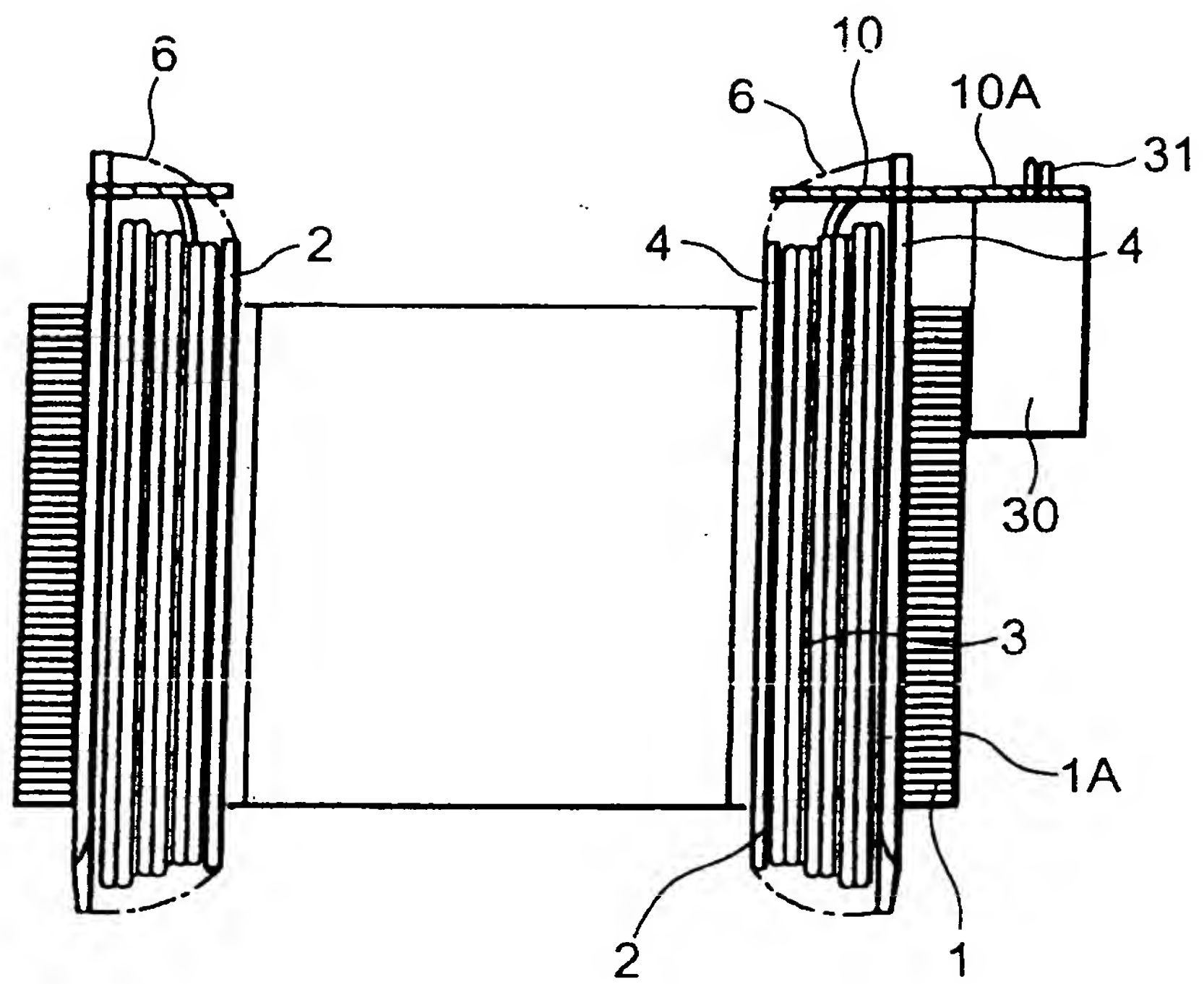


FIG. 1



2/6

FIG. 2

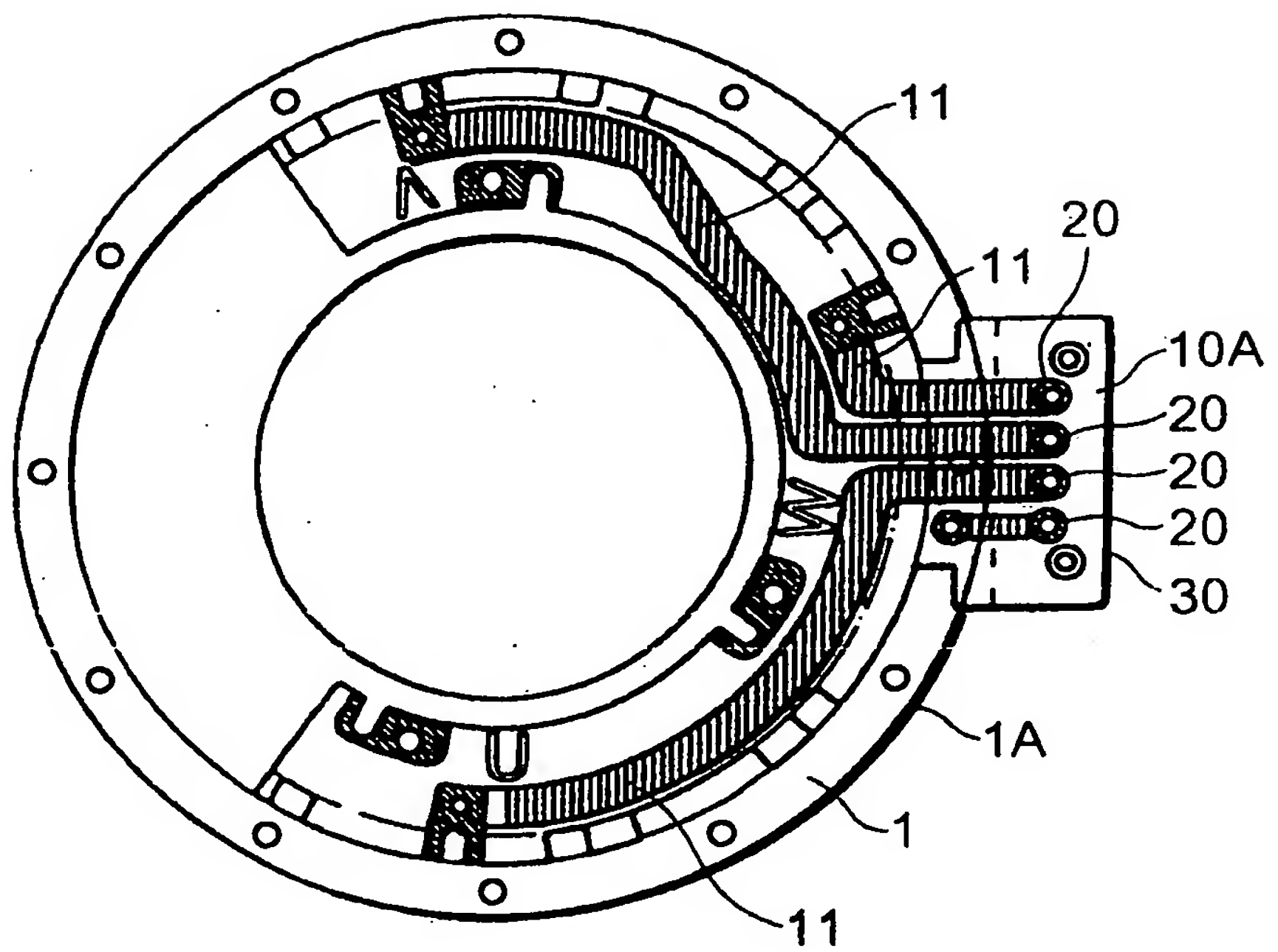


FIG. 3

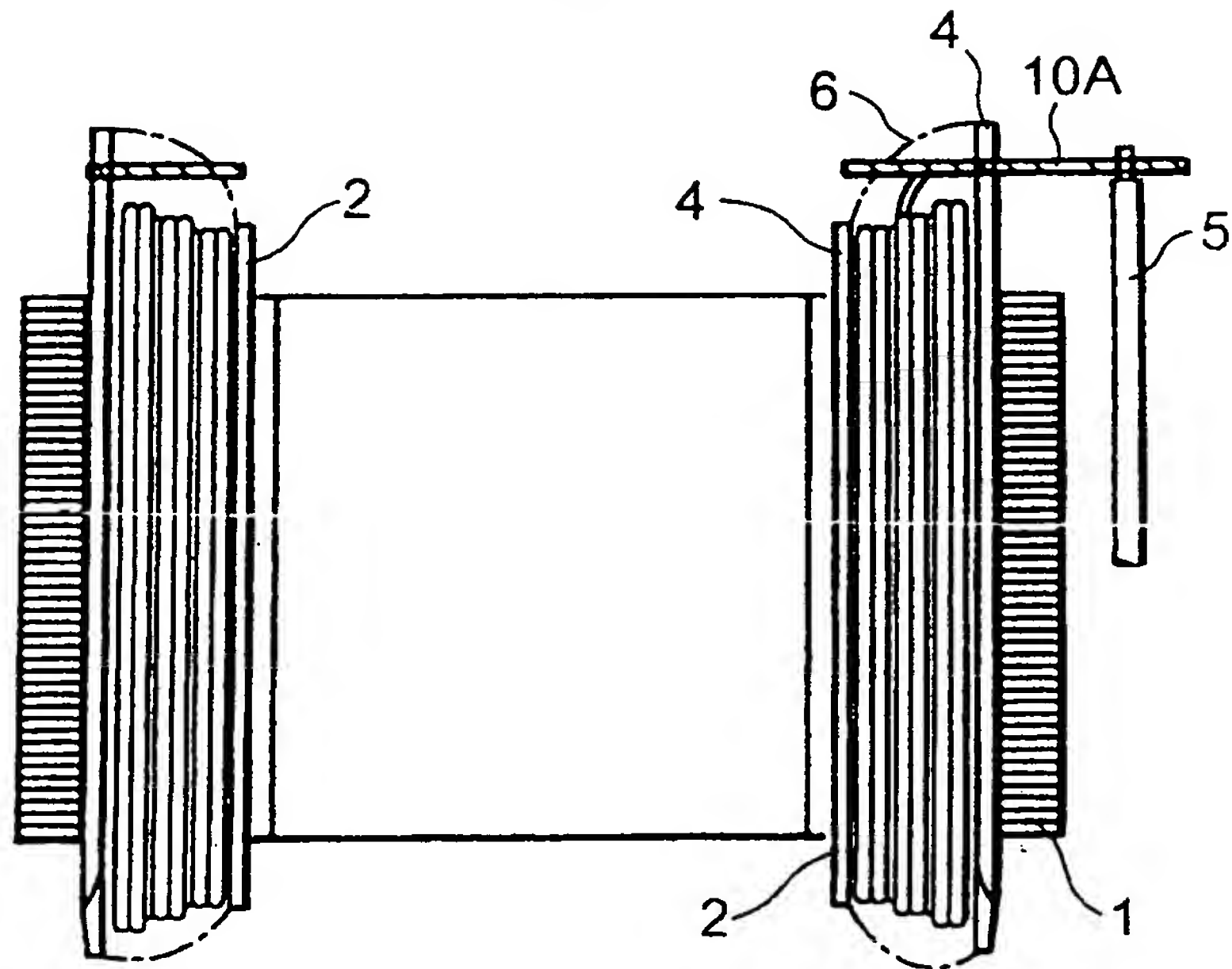
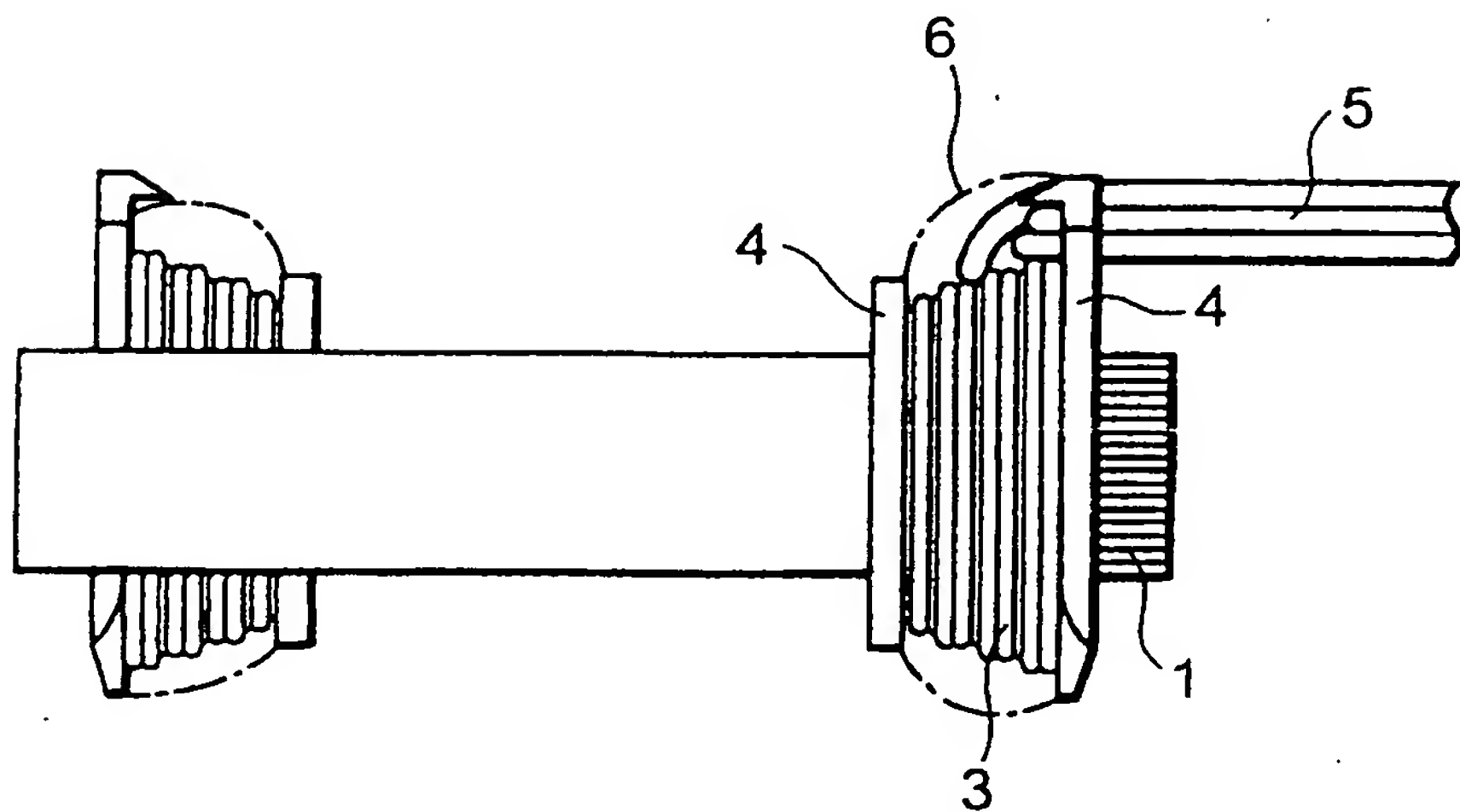
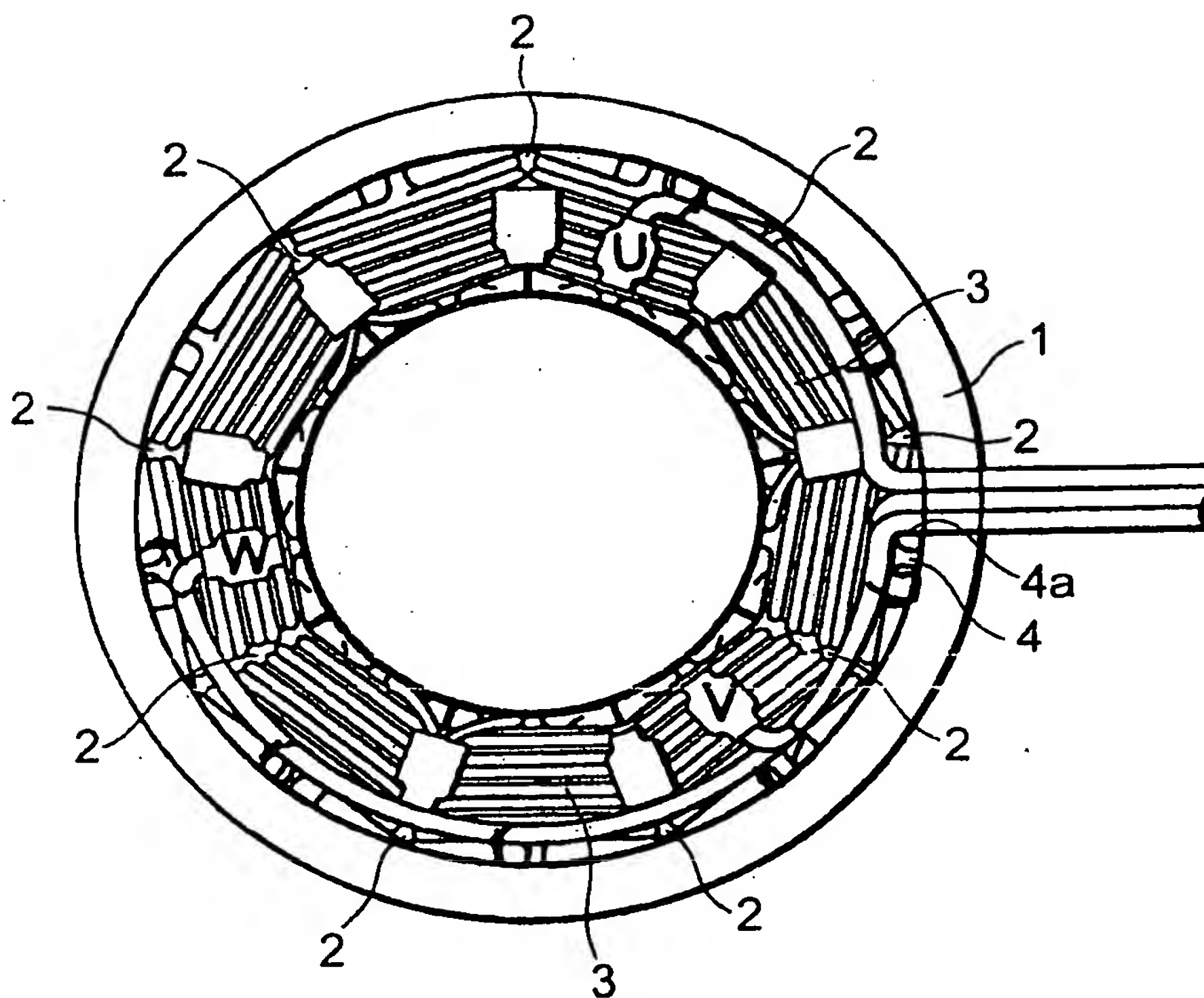


FIG. 4



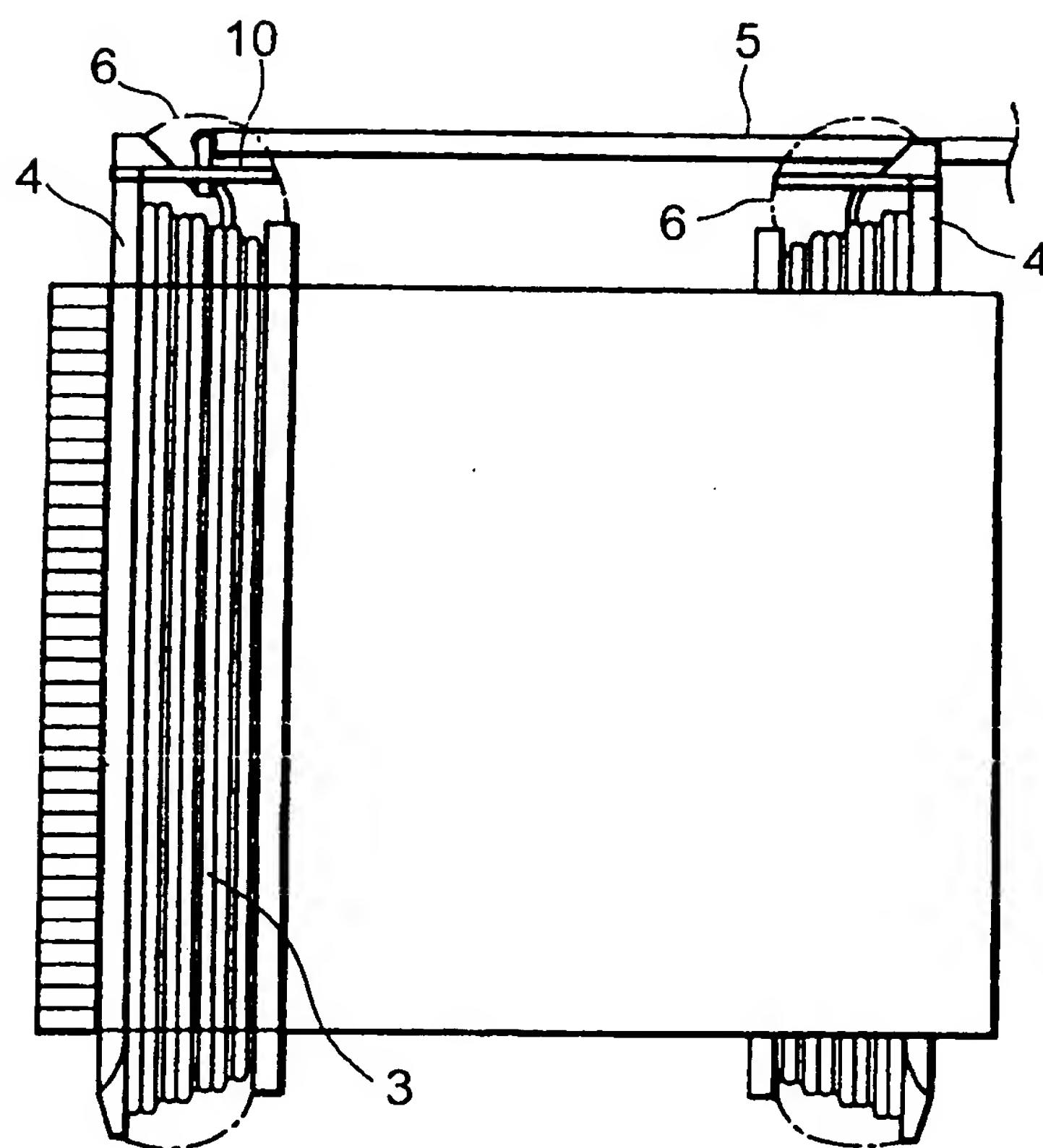
4/6

FIG. 5



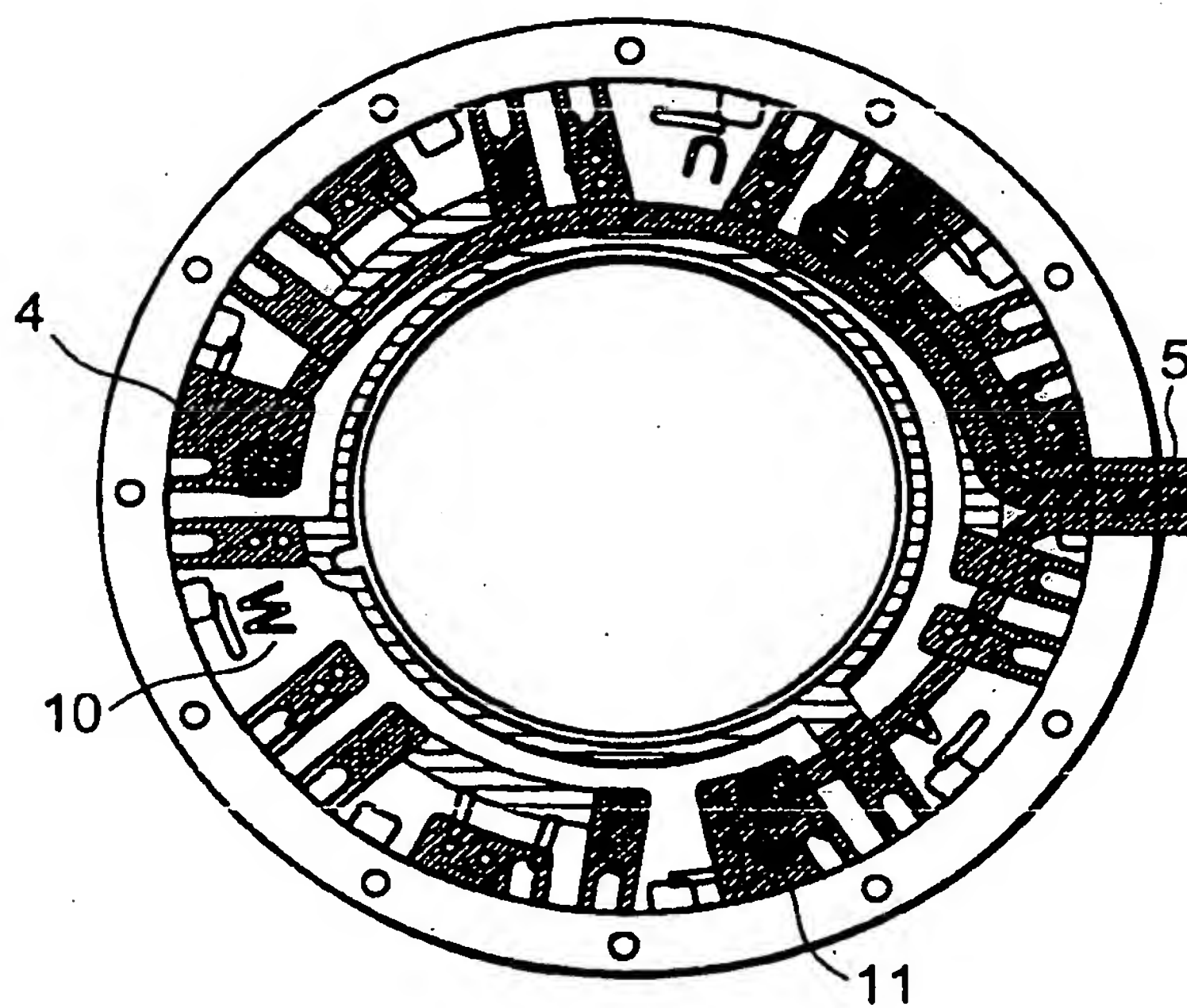
5/6

FIG. 6



6/6

FIG. 7



## STATOR STRUCTURE HAVING A PRINTED BOARD

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates to a stator structure having a printed board, and more particularly to a novel improvement in which a connector or a lead wire allows to be provided to a projected board portion that projects externally to an outer diameter position of an annular stator, whereby any of the connector and the lead wire can be freely selected as a drawing means that connects to stator windings even after the stator windings are sealed with a resin.

#### 2. Description of the Related Art

A stator structure of this kind, which is conventionally used, can be generally shown in a first conventional example shown in Figs. 4 and 5 and a second conventional example shown in Figs. 6 and 7.

That is, in case of the first conventional example shown in Figs. 4 and 5, reference numeral 1 indicates a multi-layered annular stator having an annular shape in general, and stator windings 3 of U, V and W phases are wound through an insulating cover 4 formed into an annular shape, for example, in respective slots 2 of the annular stator 1.

A lead wire 5 connected to the stator windings 3 is held in



a groove portion 4a formed in the insulating cover 4 to be guided to the outside.

Therefore, in the above-mentioned state, a resin-sealed portion 6 is formed into an annular shape, whereby the stator windings 3 and the insulating cover 4 can be resin-sealed integrally with the annular stator 1. The lead wire 5 is buried in the resin-sealed portion 6.

Further, in addition to the structure of the above-mentioned first conventional example, in case of the second conventional example shown in Figs. 6 and 7, the parts identical with or equivalent to those in the first conventional example are designated by the same reference symbols. A description therefor is omitted, and only different parts will be described. That is, an annular printed board 10, which is formed into an annular shape, is fixedly arranged in an upper portion of the insulating cover 4, and a printed pattern 11 formed on the annular printed board 10 is connected to the stator windings 3. Also, the lead wire 5 connected to the printed pattern 11 is held in the upper portion of the insulating cover 4.

The resin-sealed portion 6 is formed into an annular shape, whereby the stator windings 3 and the insulating cover 4 can be resin-sealed integrally with the annular stator 1. The lead wire 5 is buried in the resin-sealed portion 6.

The conventional stator structure is structured as described

above, and therefore, involves the following problem.

That is, in the first conventional example shown in Figs. 4 and 5, the lead wire connected to the stator windings is integrally buried in the resin-sealed portion. Thus, for example, in case of a motor, the invention has been limited to the structure in which only a lead wire is drawn from the motor.

Therefore, it has been difficult to deal with a user who requests drawing by a connector.

Further, in the second conventional example shown in Figs. 6 and 7, the annular printed board is attached to the insulating cover, and the stator windings are connected to the lead wire through the annular printed board. Thus, when the resin sealing is conducted with the resin-sealed portion, the annular printed board, the stator windings, the insulating cover and the lead wire are integrated with the resin-sealed portion. Therefore, the invention has been limited to the structure with the lead wire drawing as described above.

#### SUMMARY OF THE INVENTION

The present invention has been made to solve the above-mentioned problems, and an object of the present invention is therefore to particularly provide a stator structure having a printed board in which a connector or a lead wire allows to be provided to a projected board portion that projects externally to

an outer diameter position of an annular stator, whereby any of the connector and the lead wire can be freely selected as a drawing means that connects to stator windings even after the stator windings are resin-sealed.

A stator structure having a printed board according to the present invention comprises: stator windings provided through an insulating cover in respective slots of an annular stator; a printed board provided on one end side of the insulating cover; a projected board portion which is formed in the printed board and which projects externally to an outer diameter position of the annular stator; and printed patterns continuously formed from the printed board to the projected board portion, in which the printed patterns each have one end connected to the stator windings. Also, in the structure, through holes are provided which are formed in the printed patterns provided on the projected board portion and which are bored through the projected board portion. Also, in the structure, the projected board portion is provided with a connector arranged along the outer diameter position of the annular stator, and connector pins of the connector are insertedly arranged in the through holes. Also, in the structure, a lead wire is connected to the projected board portion while passing through the through hole, and the lead wire is positioned externally to the outer diameter position of the annular stator.

### BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

Fig. 1 is a cross-sectional view of a stator structure having a printed board according to the present invention;

Fig. 2 is a plan view corresponding to the cross-sectional view of Fig. 1;

Fig. 3 is a cross-sectional view of another stator structure different from that in Fig. 1;

Fig. 4 is a cross-sectional view of a first conventional stator structure;

Fig. 5 is a plan view corresponding to the cross-sectional view of Fig. 4;

Fig. 6 is a cross-sectional view of a second conventional stator structure; and

Fig. 7 is a plan view corresponding to the cross-sectional view of Fig. 6.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, preferred embodiments of a stator structure having a printed board according to the present invention will be described with reference to the accompanying drawings. Note that the parts identical with or equivalent to those in the conventional examples are designated by the same symbols.

In Figs. 1 to 3, reference numeral 1 indicates a multi-layered

annular stator having an annular shape in general, and stator windings 3 of U, V and W phases are wound through an insulating cover 4 formed into an annular shape in respective slots 2 of the annular stator 1.

As shown in Fig. 2, an upper portion of the insulating cover 4 is fixedly arranged with a U-shaped printed board 10 having an semi-annular shape in general which integrally has at one end thereof a projected board portion 10A that projects along the radius direction.

The projected board portion 10A has substantially a rectangular shape in plane, and is positioned such that the almost region of the shape projects externally to an outer diameter position 1A that forms an outer diameter of the annular stator 1.

On the printed board 10, printed patterns 11 are continuously formed from the printed board 10 to the projected board portion 10A, and a plurality of through holes 20, which are bored through the projected board portion 10A in a board thickness direction, are formed at one ends of the respective printed patterns 11 positioned on the projected board portion 10A. Further, the stator windings 3 are connected to the printed patterns 11.

The through holes 20 are provided with a conductive film on an inside thereof with, for example, a known through-hole technique so as to have electrical continuity with the printed patterns 11.

Accordingly, the stator windings 3, the insulating cover 4

and the annular stator 1 are integrated by being covered by the resin-sealed portion 6.

A connector 30 is attached to a lower surface of the projected board portion 10A in Fig. 1, and connector pins 31 of the connector 30 pass through the through holes 20 and are fixed by soldering or the like. Also, electrical continuity is established between the connector pins 31 and the printed patterns 11.

The connector 30 is provided externally to the outer diameter position 1A and provided to have a long shape along the outer diameter position 1A.

Further, in another embodiment of a stator structure shown in Fig. 3, a lead wire 5 is insertedly arranged in the through hole 20 of the projected board portion 10A, and the lead wire 5 is positioned externally to the outer diameter position 1A.

Therefore, in the above-mentioned embodiments shown in Fig. 1 and Fig. 3, input or output of signals to the stator windings 3 can be conducted through the connector 30 or the lead wire 5.

Further, any of the connector 30 and the lead wire 5 can be attached to the projected board portion 10A even after the resin-sealed portion 6 is provided, and any of them can be used in accordance with the request from an user. Note that the printed board 10 has a semi-annular shape, but may also have an annular shape.

The stator structure having a printed board according to the

present invention is structured as described above, and thus, the following effect can be obtained.

That is, since the projected board portion of the printed board provided in the annular stator projects externally to the outer diameter position of the annular stator, the connector or the lead wire can be directly attached to the projected board portion in accordance with the request from the user even after the resin-sealed portion of the stator windings is formed. Thus, the request from the user can be freely accepted, and therefore, the workability can be remarkably improved in comparison with the conventional case.

WHAT IS CLAIMED IS:

1. A stator structure having a printed board, comprising:  
stator windings (3) provided through an insulating cover (4) in  
respective slots (2) of an annular stator (1); a printed board (10)  
provided on one end side of the insulating cover (4); a projected  
board portion (10A) which is formed in the printed board (10) and  
which projects externally to an outer diameter position (1A) of  
the annular stator (1); and printed patterns (11) continuously  
formed from the printed board (10) to the projected board portion  
(10A), the printed patterns (11) each having one end connected to  
the stator windings (3).
2. A stator structure having a printed board according to  
claim 1, wherein through holes (20) are provided which are formed  
in the printed patterns (11) provided on the projected board portion  
(10A) and which are bored through the projected board portion (10A).
3. A stator structure having a printed board according to  
claim 2, wherein the projected board portion (10A) is provided with  
a connector (30) arranged along the outer diameter position (1A)  
of the annular stator (1), and connector pins (31) of the connector  
(30) are insertedly arranged in the through holes (20).



4. A stator structure having a printed board according to claim 2, wherein a lead wire (5) is connected to the projected board portion (10A) while passing through the through hole (20), and the lead wire (5) is positioned externally to the outer diameter position (1A) of the annular stator (1).



INVESTOR IN PEOPLE

Application No: GB 0212596.1  
Claims searched: 1 - 4

Examiner: Bill Riggs  
Date of search: 29 November 2002

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): H2A (ARB4, ARD3, ART5)

Int Cl (Ed.7): H02K (3/28, 3/50, 5/22)

Other: Online databases: EPODOC, JAPIO, WPI

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
Y	US 4039875 A (Computer Devices) see particularly pcb, figs 7 & 8	1 at least
Y	PAJ abstract & JP 2000125495 A (Matsushita) see abstract and fig.	1 at least
Y	PAJ abstract & JP 9327165 A (Janome sewing Machine) see abstract and fig.	1 at least
Y	PAJ abstract & JP 10191615 A (Tokyo Electric) see abstract and fig.	1 at least
Y	PAJ abstract & JP 62290343 A (Matsushita) see abstract and fig.	1 at least
Y	PAJ abstract & JP 61214740 A (Matsushita) see abstract and fig.	1 at least
Y	PAJ abstract & JP 58009563 A (Mitsubishi) see abstract and figs.	1 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.